CLAIMS

WHAT IS CLAIMED IS:

1. A method of manufacturing an optical fiber, comprising the steps of:

providing a first section of a preform having a concentration of a first halogen;

providing a second section of the preform having a concentration of a second halogen of at least approximately 1% by weight; and

processing the preform having the first and the second sections to form an optical fiber having corresponding first and second fiber sections wherein a stress between the first and second fiber sections is less than that of a pure silica-core optical fiber.

2. The method of claim 1 wherein the first fiber section of the fiber is a cladding and the second fiber section of the optical fiber is a core.

3. The method of claim 1 wherein the first halogen is fluorine and the second halogen is chlorine.

4. The method of claim 1 wherein the optical fiber has an attenuation of approximately 0.183 dB/km or less at between about1520 nm and 1570 nm.

5. The method of claim 1 wherein the step of providing the first section further includes providing a substrate tube and providing a first gas mixture including the first halogen to coat the substrate tube to form the first section.

6. The method of claim 5 wherein the step of providing the second section includes providing a second gas mixture including the second halogen to the substrate tube to coat the first section to form the second section.

7. The method of claim 6 wherein the step of providing the second section further includes configuring at least one of a temperature of the substrate tube and a ratio of the second gas mixture to control a concentration distribution of the second halogen in the second section.

8. The method of claim 7 wherein the first or second gas mixture includes $SiCl_4$ and O_2, and the ratio of O_2:$SiCl_4$ is between about 2:1 and 3:1.

9. The method of claim 7 wherein the configuring step includes configuring a temperature of an internal portion of the substrate tube.

10. The method of claim 7 wherein the configuring step includes configuring the temperature of the substrate tube during the coating step.

11. The method of claim 10 wherein the configuring step includes providing a temperature surrounding the substrate tube during the coating step that is lower than a temperature surrounding the substrate tube during formation of the first section.

12. The method of claim 11 wherein the temperature surrounding the substrate tube during the coating step is smaller than the temperature surrounding the substrate tube during formation of the first section by between about 100°C and 300°C.

13. The method of claim 1 wherein a concentration distribution of the second halogen in the second section of the optical fiber is selected from a group including a step function, a Gaussian distribution, and an exponential function.

14. The method of claim 1 wherein the stress between the first section and the second section of the optical fiber is reduced approximately by a factor of 2 relative to the pure silica-core optical fiber.

15. An apparatus for coating a substrate tube used to form an optical fiber, comprising:

a gas delivery unit configured to provide gas mixtures inside of the substrate tube; and

a heat source surrounding at least a portion of the substrate tube, wherein inside the substrate tube is formed a first section having a first halogen

concentration and a second section having a second halogen concentration, the first section and the second section each having halogen concentrations being at least approximately 1% by weight.

16. The apparatus of claim 15 wherein a temperature of the inside of the substrate tube is between about 100°C and 300°C less during formation of the second section than during formation of the first section.

17. The apparatus of claim 16 wherein the heat source is configured to affect the temperature of the inside of the substrate tube.

18. The apparatus of claim 15 wherein the gas mixtures include $SiCl_4$ and O_2, and a ratio of O_2:$SiCl_4$ is between about 2:1 and 3:1.

19. The apparatus of claim 15 wherein the first section is a cladding and the second section is a core.

20. The apparatus of claim 15 wherein the first halogen concentration includes fluorine and the second halogen concentration includes chlorine.

21. The apparatus of claim 20 wherein the second halogen concentration in the second section is a function of a partial pressure of chlorine in the gas mixtures.

22. The apparatus of claim 15 wherein the optical fiber is a silica-based fiber and is configured to provide attenuation of approximately 0.183 dB/km or less at a wavelength in the range of 1520-1570 nm.

23. An optical fiber, comprising:

a first section doped with a concentration of a first element; and

a second section abutting the first section along an axial direction and doped with a concentration of a second element, wherein the concentration of the first element and the concentration of the second element are configured to provide a substantially matching viscosity across an interface associated with the first and the second sections and the optical fiber is a silica-based optical fiber.

24. The fiber of claim 23 wherein the first section is a cladding and the second section is a core.

25. The fiber of claim 23 wherein at least one of the first and second element comprises a halogen.

26. The fiber of claim 23 wherein the concentration of the second element in the second section is increased by forming the second section at a temperature less than about 1150°.

27. The fiber of claim 23 wherein the concentration of the second element in the second section is a function of a partial pressure of the second element during formation of the second section.

28. The fiber of claim 23 wherein the second element is chlorine and the concentration of the second element in the second section is at least 1% by weight and the concentration of the second element in the first section is less than approximately 0.1% by weight.

29. The fiber of claim 28 wherein the first element is fluorine and the concentration of the first element in the first section is greater than 1% by weight and the concentration of the first element in the second section is approximately zero.

30. The fiber of claim 23 wherein a tensile and compression pressure induced across the interface is approximately 15 Mpa or less.

31. A method of forming a glass article having a first section and a second section, the first section adjacent the second section, the method comprising the steps of:

providing a gas mixture to a glass tube;

first coating the glass tube to form the first section;

second coating the first section to form the second section wherein the first section has a concentration of a first halogen and the second section has a concentration of a second halogen; and

processing the glass tube having the first and second sections to form the glass article wherein at least one of a partial pressure of the second halogen in the gas mixture and a temperature of the glass tube is configured to affect the concentration of the second halogen in the second section.

32. The method of claim 31 further including configuring the temperature of the glass tube to be less during the second coating step than during the first coating step.

33. The method of claim 32 wherein the configuring step includes configuring the temperature of the glass tube during the second coating step to be between about 100°C and 300°C less than during the first coating step.

34. The method of claim 31 wherein the providing step includes providing the partial pressure of the second halogen during the second coating step in the range of 2-10 Torr.

35. The method of claim 31 wherein the temperature of the glass tube is a temperature of an internal portion of the glass tube.

36. The method of claim 31 wherein the second halogen is chlorine and the concentration of the second halogen in the second section is in a range of between about 0.7% and 1.0% by weight.

37. The method of claim 36 wherein the first halogen is fluorine and the concentration of the first halogen in the first section is in a range of between about 1.0% and1.3% by weight.